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A TECHNIQUE FOR PROJECTION OF OCCUPATIONAL-EDUCATIONAL REQUIREMENTS FOR STATE EDUCATIONAL PLANNING AREAS.

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THE OBJECTIVE OF THE OCCUPATIONAL-EDUCATIONAL REQUIREMENTS PROJECTION SYSTEM IS TO PROVIDE LONG-RANGE (10-YEAR) PROJECTIONS OF EDUCATIONAL NEEDS BASED ON ANTICIPATED LEVELS OF INDUSTRIAL EMPLOYMENT. THE SYSTEM WILL BE USED BY THE BUREAU OF ADULT AND VOCATIONAL EDUCATION AND THE BUREAU OF HIGHER EDUCATION IN SELECTING PROGRAMS TO BE DEVELOPED OR PHASED OUT. AS A BASIS FOR PROJECTING EDUCATIONAL NEEDS, PHASE ONE OF THE PROGRAM WILL USE EMPLOYMENT PROJECTIONS FOR OCCUPATIONAL AREAS WHERE AGRICULTURAL, DISTRIBUTIVE, HEALTH OCCUPATIONS, HOME ECONOMICS, OFFICE OCCUPATIONS, TECHNICAL, AND TRADE AND INDUSTRIAL EDUCATION WOULD HAVE EQUIPPED PERSONS FOR JOBS. THESE EMPLOYMENT PROJECTIONS, PREPARED BY THE NATIONAL PLANNING ASSOCIATION, ARE BY STATE AND 82 SEPARATE METROPOLITAN REGIONS FOR THE YEARS 1970 AND 1975. METROPOLITAN AREAS WITHIN A STATE WILL BE USED AS EDUCATIONAL PLANNING AREAS AND THE REMAINDER OF THE STATE AS SEPARATE PLANNING AREA. EMPLOYMENT PROJECTIONS WILL BE ALLOCATED AMONG OCCUPATIONS ACCORDING TO COEFFICIENTS PRODUCED FROM THE 1960 CENSUS. FOR EDUCATIONAL PLANNING PURPOSES, THESE EMPLOYMENT REQUIREMENTS MUST BE CONVERTED TO EDUCATIONAL EQUIVALENTS. THIS IS TO BE DONE WITH A CONVERSION MATRIX WHICH WILL MATCH EACH CENSUS OCCUPATION TO A STANDARDIZED EDUCATIONAL CATEGORY. A CONTINUING LIAISON WITH THE BUREAUS OF ADULT AND VOCATIONAL AND HIGHER EDUCATION IS PLANNED TO INSURE THAT THE SYSTEM WILL BE RESPONSIVE TO THEIR OPERATING REQUIREMENTS. (HC)

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A TECHNIQUE FOR PROJECTION OF OCCUPATIONAL-EDUCATIONAL REQUIREMENTS FOR STATE EDUCATIONAL PLANNING AREAS

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A Technique for Projection Of Occupational-Educational Requirements For State Educational Planning Areas

The objective of the "Occupational-Educational Requirements Projection System" is to provide long-range (10-year) projections of educational need based on anticipated levels of industrial employment; the methodological approach is described below and is relatively straightforward. The initial problem was that of insuring that results would be related in a meaningful way to operational requirements of the appropriate bureaus in the Office of Education. Discussions with personnel in the Bureau of Adult and Vocational Education, the Bureau of Higher Education, and the Division of Data Sources and Standards enabled us to design a projections system which would focus on their planning problems in a meaningful way.

Although more details are given below, we feel that the system now evolving will permit them to be more selective in the programs which they will be developing, on the one hand, or phasing out, on the other. Furthermore, they will possess information on future employment trends which will permit much more precision in the guidance given to states in their own program.

A continuing liaison with these Bureaus is planned in order to obtain their continuing participation in the evolution of the system and to insure that the system will be responsive to their operating requirements. The ultimate test, of course, is the extent to which the system provides results which will be meaningful at the local level.

With these general objectives in mind, and based on initial discussions with the Bureaus mentioned above, we can describe in several terms the educational requirements projection system currently being developed. Specifically, these projections specify for each region of the United States the number of jobs requiring a specified education background. Once the system is operative, information on educational categories and regions (both of which are defined below) can be aggregated at state or larger area levels.

I. EDUCATIONAL PLANNING IN THE OFFICE OF EDUCATION

A review of the planning functions of the Bureau of Vocational Education and Technical Training is useful in order to describe their approach and indicate the need for an educational requirements projection system.

Financial aid for programs in vocational and technical education are allocated to States on the basis of formulae fixed by legislation. Frequently, legislation will also allocate financial resources among educational programs such as agriculture, technical and industrial, and home economics. As a condition for receiving this aid, States are required to submit a one-year plan in which they identify job opportunities and the availability of trained manpower. These data are obtained through cooperative agreements with the State's Bureau of Employment Security. However, much of these data are based on 7 or 8 year old surveys and subsequent projections are usually prepared for only one year. This can be a severe shortcoming particularly in the case of planning a facilities construction program.

For establishing curricula, the Office of Education operates at the local level, providing advice to vocational educational planning committees which include representatives from educational institutions, labor unions, and private business. These groups have been estimating the future needs for vocational and technical programs in their local areas. The final decision, furthermore, for any program rests with the local authorities since they provide 50 percent or more of the funds.

Among the specific services offered by the Office of Education to these local groups are (a) course instruction materials; (b) collection, coordination, and distribution of data from nationwide data sources; (c) program planning for the local implementation of vocational courses; and (d) analysis of facilities requirements to provide maximum flexibility for future programs. More generally, the Office of Education provides the latest available information on technological change, equipment requirements, and (for facilities) environmental control conditions.

To facilitate planning, the vocational education experts have attempted to categorize a number of broad occupational groupings. Specific course materials are then prepared within these categories. In the agricultural categories, for example, they are developing instructional materials for courses in horticulture, landscaping and agricultural chemicals. The planning group has a continuously changing list of new and emerging occupational areas under consideration. Approximately 400-500 courses are now in the vocational educational program. A typical new area school will offer as many as 40 to 50 of these courses.

The organization of Federal aid to state higher educational programs varies from that of vocational programs. The basic decision-making body is the State Board of Higher Education rather than the State Board of Education (suggesting the possibility of lack of coordination). The method of allocating funds is based on a rating system in which, among other things, the number of additional students benefited, extent of current plant utilization, and degree of dependence on existing facilities all carrying varying weights. The State Board then allocates funds on a statewide basis according to these criteria. Since 22 percent of the funds flowing to the States for higher education programs are earmarked for improvements in technical facilities, and since these commitments are obviously going to have a greater impact on future programs then on current programs, it seems especially important to develop long-range projections of future needs.

II METHODOLOGICAL PROCEDURES

The output format of the report is shown in Figure I. (For initial runs, we will consider only the seven broad vocational education categories shown there.) To clarify the significance of the projections, we should point out that they do not say that the indicated number of persons actually will have had training in these educational categories, but rather that this number of persons will be employed in occupations for which training in the educational category would have equipped them. Bear in mind that the figures are total numbers of people employed and that many will have entered the labor force in prior years. Thus, some of their training will have come through experience on the job, on-the-job training, and other informal training arrangements. Many of them may be either untrained or inadequately trained for their occupations.

Projected Employment By Type of Training
Educational Planning Area (Name)

	Agriculture	Distributive Education	Health Occupations	Home Economics	Office Occupations	Technical Education	Trades & Industry
1966	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1967	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1968	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1969	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1970	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1971	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1972	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1973	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1974	XXX	XXX	XXX	XXX	XXX	XXX	XXX
1975	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Figure 1

It is clear, therefore, that we have made a direct conversion from occupation to the educational program leading to that occupation, regardless of whether a specific individual did, in fact, receive training in that category prior to entering his occupation. We assert, however, that to the extent requirements for trained personnel can be foreseen and training programs carried out, we can attain a more satisfactory matching of skills to jobs, higher productivity on the job will be achieved, and there will be an enhanced contribution of the individual to his own and his employer's satisfaction.

The first step in the methodological procedure is that of identifying the categories relevant to educational planning and decision making. The previous discussion of educational planning makes it clear that we will have particular interest in regional and educational categories. Both of these will be rather crudely defined in our initial projections. In the case of the former, we shall define Educational Planning Areas (EPA) which will be based on standard metropolitan areas (with better specifications left for later studies). Employment projections will be related to these EPA's.

Educational categories are presently being studied within the Center and formal definitions are in preparation. A preliminary list of 300-400 has been prepared by the Data Sources and Standards Division and will be sent to the field for review and comment. However, for Phase I of our work, we will restrict ourselves to the seven broad categories indicated in Figure I, with later refinement to be based on discussions with, in this case, the Bureau of Vocational Education and Technical Training.

Since States will eventually be asked to report programs on the basis of these categories, it seems appropriate that we use them in our projection system.

For Phase I, we will use employment projections prepared by the National Planning Association. These projections are by state and, separately, 82 metropolitan regions, for each of eleven industrial sectors for the years 1970 and 1975. We will use metropolitan areas as EPA's with the remainder of the state as a separate EPA. The steps in the process are:

(a) Employment

Employment projections for industries will be allocated among occupations according to coefficients produced from the 1960 Census. We can recognize two methodology problems in this procedure which should be considered. First, within an industry the structure of occupation may vary from one geographical area to the next. At the moment, we regard this as a relatively unimportant problem, but we do plan to establish whether there are statistically significant differences in industry/occupation coefficients among metropolitan areas. Secondly, the occupational structure of an industry will change over time. This is a more serious problem which is only partially ameliorated by the fact that the actual work content of a specific occupation will tend to be upgraded over time. We do not plan to deal with this problem in our first projection but hope to develop an improved technique at some later stage. The Bureau of Labor Statistics is preparing a detailed matrix of projected occupational coefficients which we might easily adapt for our system.

(b) Transition to Educational Categories

For educational planning purposes, it is necessary to convert the occupational requirements to educational equivalants. For Phase I, we are preparing a conversion matrix which will match each Census occupation to a standardized educational category; the first effort will include only the seven educational categories of Figure I (which happens to be those most closely related to vocational training).

Ideally, we should like to study industries in terms of their direct requirements for personnel with a specific educational background, thus avoiding the uncertainties imposed by going first to an occupational structure. Unfortunately, such an approach appears to be beyond the present "state-of-the-art."

III CHECKS AND FEEDBACKS

Several approaches for validating results of our analysis have been considered. Generally, they take the form of comparing projections provided by other agencies. Hence, it is necessary to design our system so that results can be comparable to outputs of other agencies. In addition to the problem of making comparable projections, we should like to have comparability with current data from census and surveys so that we can adjust our projections automatically to reflect current status.

(a) Projections of Total Employment

The BLS presently publishes several series on projected manpower requirements by occupation. Although their occupational groups are highly aggregated, they may be useful for comparison with summaries of our occupational data. Hopefully, our system would have the capability of accepting exogenous totals such as these and automatically scaling detailed results to match them.

(b) Base Line Data

The purpose of establishing base lines is to insure that the projections are also consistent with current status -- to the extent that current status is known. Establishment of the base lines can utilize information from the BLS and the Current Population Surveys. We can also use Labor Market Data which is provided bimonthly by the Bureau of Employment Security.

Reference Tables

1. "Employment, by Major Occupation Groups, 1964, and Projected Requirements, 1975" Technology and The American Economy, p. 45 National Commission on Technology Automation and Economic Progress (approximately 12-15 occupational categories) - Brazeal.

2. "Distribution of Total Labor, by Age and Sex; Actual 1960 then 70, 75, 85" Monthly Labor Review February 5, 1965. (age groupings based on population, labor force participation rates) Department of Labor, BLS based on population data from the Bureau of the Census Denis Johnston.

3. "Employment of Nonagricultural Wages and Salary Workers, by Industry, 1964, and Projected Requirements, 1975", Technology and The American Economy p. 43 National Committee on Technology Automation and Economic Progress (approximately 30-35 industrial categories) evidently from (4) below.

4. "Special Labor Force Report, No. 53" Monthly Labor Review, May 1965. Educational Attainment of Workers, March 1964 - Denis F. Johnston - Conducted through Current Population Survey.

5. Bureau of the Census "Current Population Reports" Population Estimates, p. 25 No. 326. (Preferable to use Migration Series II - gradual damping toward national average and drop in fertility rates, i.e., II-D).

6. "Table A-19 Long Term Unemployment by Major Industry and Occupation Group: Annual Ages. 1957-64" Manpower Report of the President, March 1965.

7. "Table J-5 Percent Change in Employment by Major Occupation Group and Region, 1950-60" /67.

APPENDIX

I. EMPLOYMENT PROJECTIONS BY EDUCATIONAL PLANNING AREA (EPA)

This section describes detailed steps leading to educational category projections by EPA, for Phase I. Phase I is the initial short-term effort to prepare preliminary projections, while Phase II should be regarded as the continuing long-term program aimed at upgrading component parts of Phase I and, hence improving credibility of end results for planning purposes.

The basic projection data which we will use are those of the National Planning Association (NPA) for 82 metropolitan areas and the 50 states. (See Refs. D-3 and D-4). Since the NPA projections are for states and metropolitan areas, they must be converted to EPA's, -- for Phase I we use each NPA metropolitan area as an EPA and the "Rest of the State" as a residual, single, EPA. (See Tables A and B for the form of the EPA specification and the industry list, respectively.) The resulting punch card file (Table I) has the form.

Item	Card Column
State	1-2
EPA	3-5
Industry	7-10
Employment	
1950	11-15
1957	16-20
1960	21-25
1962	26-30
1970	31-35
1975	36-40

II. THE INDUSTRY-OCCUPATION-EDUCATIONAL CATEGORY STRUCTURE

Each industry has an occupational structure, i.e., total employment in an industry can be divided among occupations according to a set of fixed coefficients. These coefficients are assumed to apply to the industry as whole regardless of geographic location, an assumption which we shall later wish to test.

In computer memory we establish an m x n matrix, where m is the number of industries we wish to use (11) and n the number of educational categories (7). We also establish in memory a table relating Census industries to ours, and another relating Census occupations to our educational categories. Reading the Census tape (1/1000) we count each record into the appropriate cell of our m x n matrix by crossclassifying according to industry and occupation.

After filling the matrix, each element is divided by its corresponding industry total, giving the distribution of total industry employment by educational category. The result matrix is punched out in the format:

Item	Card Column
Industry	2-3
Educational Category	7-10
Coefficient	11-15
Repeat	16-30
"	31-45
"	46-60
"	61-75

III THE EDUCATIONAL CATEGORY PROJECTION

The above two files contain the information necessary to prepare the report described in Figure 1 of this note. It will be noted that the first result, above, is an m x t matrix for each EPA and the second m x n matrix where there are m industries, n educational categories, and t years in the projections. Transposing the former and multiplying yields the t x n matrix, i. e., the projections of educational requirements.

Since our projections are for the years 1970 and 1975, we will make exponential projections to obtain intervening years.

Data Source Documents

D-1 Bureau of the Census, U.S. Census of Population, 1960: Occupation by Industry, Washington, 1963.

*D-2 U.S. Office of Education, Division of Data Sources and Standards, Review Guide to The Cooperative Project for Standardization of Terminology in Instructional Programs of Local and State School Systems, Preliminary edition (mimeo), Washington, 1966. (Chapters 4 and 5).

**D-3 National Planning Association - Center for Economic Projections, Economic & Demographic Projections for Eighty-two Metropolitan Areas, Report No. 66-R-1, Washington, 1966.

**D-4 ---, State Projections to 1975, Report No. 65-II, Washington, 1965.

D-5 Bureau of Employment Security, Labor Market Area Definitions, (file copy) August 1951.

D-6 ---, Directory of Important Labor Market Areas, 4th Edition, July 1954. Also Supp. No. F, February 1962 and Supp. No. 8, July 1963.

D-7 Bureau of the Budget, Standard Metropolitan Statistical Areas, Washington, 1964.

*D-8 BLS, Employment & Earnings Statistics for States & Areas, 1939-64, Washington, 1965 June.

*D-9 OBE, Growth Patterns in Employment by County, Washington, 1965.

*D-10 Bureau of the Census, Current Population Reports Series P-25, No. 326, Washington, February 1966.

*Already have

**In HEW Library

Table A. Phase I Educational Planning Areas*

State	-	LMA			
01	-	01	Maine	-	Lewiston - Auburn
01	-	02	"	-	Portland
01	-	99	"	-	Rest of State
02	-	01	New Hampshire	-	Manchester
02	-	99	" "	-	Rest of State
03	-	99	Vermont	-	Entire State
04	-	01	Massachusetts	-	Boston
04	-	02	"	-	Lawrence - Haverhill
04	-	03	"	-	Lowell
04	-	99	"	-	Rest of State
**05	-	01	Rhode Island	-	Providence - Pawtucket
05	-	02	"	-	Rest of State
06	-	01	Connecticut	-	Hartford
06	-	02	"	-	New Haven
06	-	03	"	-	New London - Groton - Norwich
06	-	04	"	-	Rest of State
.		.	.		.
.		.	.		.
.		.	.		.

*Based directly on projections of the National Planning Association [Ref. D-3].

** Includes parts of another state.

Table B. Industrial Sectors

Phase I Industry Categories (NPA 82-Metro Area Projections)		Phase II Industry Categories (Various Sources)	
SIC	Title	SIC	Title
0	Agriculture	01-07	Agriculture
		08-09	Forestry & Fisheries
10-14	Mining	10-14	Mining
15-17	Construction	15-17	Contract Constructions
19-39	Manufacturing	20-21	Food & Kindred products
		22	Textile mill products
		23	Apparel & related
		26	Paper & allied products
		27	Printing,publishing, etc.
		28	Chemicals & related products
		29	Petroleum & related products
		30	Rubber & plastic products
		31	Leather and products
		19	Ordanance
		24	Lumber & wood products
		25	Furniture & fixtures
		32	Stone, clay & glass products
		33	Primary metals
		34	Fabricated metal products
		35	Nonelectrical machinery
		36	Electrical machinery
		37	Transportation equipment
		38	Instruments & related equip.
		39	Miscellaneous manufacturing
4	Transportation, communications & public utility	40	Railroads & railway express
		42	Trucking & warehousing
		41,44-47	Other transport
		48	Communications
		49	Utilities & sanitary serv.
50	Wholesale trade	50	Wholesale trade
52-59	Retail trade	54	Food & dairy product stores
		58	Eating & drinking places
		52,53,55-57,59	Other retail trade
6	Finance, insurance & real estate	6	Finance & insurance & real estate
7-8	Services	70-72	Hotels & other personal serv.
		88	Private households
		73-76	Business & repair services
		78-79	Entertainment, recreation serv.
		80-86,89	Medical, other professional services
91	Federal government	91	Federal government
92-93	State & local government	92-93	State & local government

Note: As a convention for data processing purposes, we will use the lowest two-digit code applicable to each group.